MARITIMES RESEARCH VESSEL SURVEY TRENDS

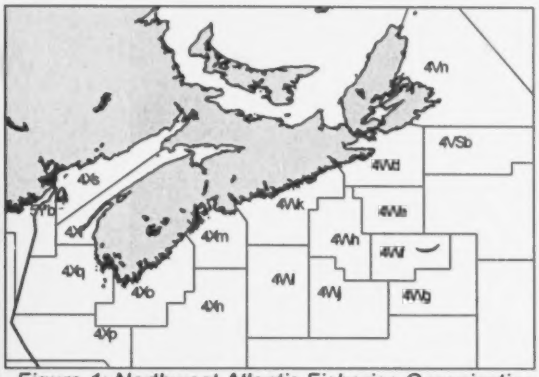

Figure 1: Northwest Atlantic Fisheries Organization (NAFO) Unit Areas.

Context

DFO has conducted summer research vessel (RV) surveys in the Maritimes Region, Northwest Atlantic Fisheries Organization (NAFO) subunits 4VWX and a small portion of 5Y, using a standardized protocol since 1970. Results of these surveys provide information on trends in abundance for most groundfish species on the Scotian Shelf. While these data reflect trends in biomass and abundance and are a critical part of science-based stock assessments, a full assessment, including other sources of data, would be required to evaluate the impacts of management measures on population status. Fisheries and Aquaculture Management (FAM) requested a review of the DFO RV survey information on the following list of fish stocks: 4Vn cod, 4VsW cod, 4X5Y cod, 4VW haddock, 4X5Y haddock, 4VW white hake, 4X5Y white hake, 4VWX5 silver hake, 4VWX5Y pollock, Unit 3 redfish, 4VW flatfish, and 4X5Y flatfish.

Full assessments will not be conducted for these stocks in 2010. The survey information will be used by DFO Resource Management as background for discussions with various industry stakeholders on recommendations for management measures, and to determine which stocks should be reviewed in more detail in 2011.

Summary

- Biomass indicies are compared with the 2009 index as well as averages over 3 time periods; short term being most recent 5 year average, medium term being most recent 15 year average and long term being since the beginning of the survey series, or the period deemed appropriate for that particular species.
- Biomass indices for 4X cod, while comparable to short and medium term averages in 2009 are both low in 2010
- Biomass indices for 4Vn cod in 2009 and 2010 are well above short and medium term averages.

- Biomass indices for 4VsW cod in 2009 and 2010 are well above short and medium term averages.
- Biomass indices for 4X haddock in 2009 and 2010 have no consistent relationship to short and medium term averages.
- Biomass indices for 4VW haddock in 2009 and 2010 have no consistent relationship to short and medium term averages.
- Biomass indices for 4X white hake in 2009 and 2010 are well above short and medium term averages.
- Biomass indices for 4VW white hake in 2009 and 2010 have no consistent relationship to short and medium term averages.
- Biomass indices of 4VWX5 silver hake in 2009 and 2010 are above short and medium term averages.
- Biomass indices for 4VWX5 pollock, while comparable to short and medium term averages in 2009 are both low in 2010.
- The recent average biomass indices for Unit III redfish are above the medium tem and long term average and the indices remain high relative to the long term average in 2009 and 2010.
- Winter flounder biomass indices in 4X in 2009 and 2010 are at the highest levels observed in the time series and well above short, medium and long term averages.
- Biomass indices for 4VW American Plaice in 2009 and 2010, were below short, medium and long term averages.

Background

The DFO summer research vessel (RV) survey of the Scotian Shelf and Bay of Fundy has been conducted annually since 1970. The survey follows a stratified random sampling design, and includes sampling of fish and invertebrates using a bottom otter trawl. These survey data are the primary data source for monitoring trends in species distribution, abundance, and biological condition within the region, and also provide data to the Atlantic Zonal Monitoring Program (AZMP) for monitoring hydrographic variability. There were changes to the net used and the vessel conducting the survey in 1982 and 1983, along with some changes in data collection protocols. These changes may affect the biomass trends for some species. For long-term averages, the most appropriate starting point has been selected for each species (for details see Clark and Emberley, 2010).

The bottom trawl survey was designed to provide abundance trends for groundfish between depths from about 50m to 400m. Survey indices are expected to be proportional to abundance for most species. The distribution of some species, such as cusk and turbot, may not be fully covered by the survey. Abundance trends for these species may only provide indication of direction of change over time. Similarly, for pelagic species, such as herring, which are distributed broadly throughout the water column, bottom trawl catches may not reflect abundance trends. For all these species, other biological information collected during the RV survey, such as length and weight will still be useful for analysis.

For the purpose of this report, the survey area has been divided into three zones, based on oceanography and biogeography (Fig. 2). Catch distribution plots are provided for the entire survey area. Biomass index trends are shown for the entire survey area, as well as for three separate regions: Eastern Scotian Shelf (4VW; strata 440-466), Western Scotian Shelf (4X East; strata 470-481), and Gulf of Maine/Bay of Fundy (4X West; strata 482-495).

Differences in patterns of fish abundance and species composition are apparent for these regions during the survey.

Comparisons of stratified length frequencies for 2009 and 2010 to the long-term mean are also included for major commercial fish species as well as trends of condition (Fulton's K; weight/length^3).

Analysis

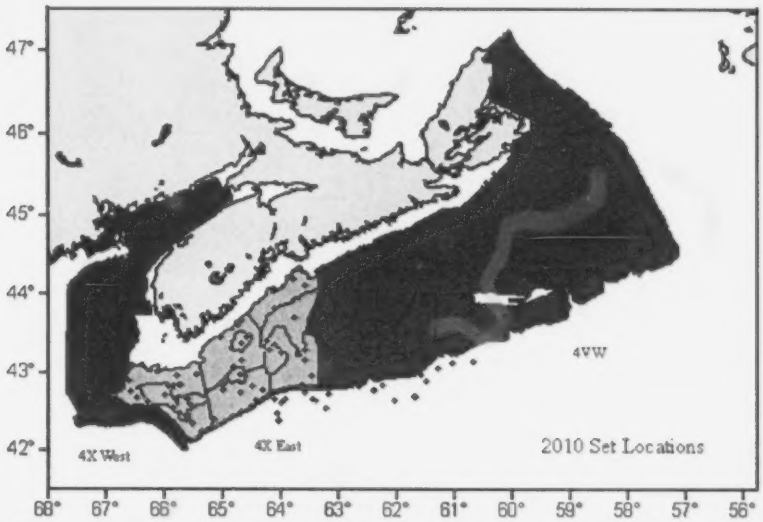

Figure 2. 2010 Summer Research Vessel Survey station distribution. Geographic areas (strata) used in calculating catch for 4VW are shaded pink, those used for 4X East are shaded grey and those used for 4X West are shaded blue.

Table 1. Comparison of 2010 biomass estimate with 2009 estimate, recent 5 year average (2005-2009), recent 15 year average (1995-2009), and the long term average (1970-2009).

	Biomass (mt)				
Stock/Region	2010	2009	2005-2009 Avg	1995-2009 Avg	*1970-2009 Avg
4VsW Cod	35003	61341	26606	14371	54002
4Vn Cod	6488	9688	4191	5397	16242
4X5Y Cod (4X east)	1835	8042	3213	4663	8428
4X5Y Cod (4X west)	1203	6930	4974	10809	13412
4VW Haddock	48339	158331	79637	63521	61228
4X5Y Haddock (4X east)	26834	49564	39011	34753	34813
4X5Y Haddock (4X west)	18702	17089	15375	23188	22501
4VW White Hake	5507	6160	5719	6047	10414
4X5Y White Hake (4X east)	1748	2736	1555	1602	2759
4X5Y White Hake (4X west)	12587	17089	11304	11865	16435
4VW Silver Hake	29024	28782	15570	18783	23885
4X5Y Silver Hake (4X east)	8764	8988	4976	5887	10077
4X5Y Silver Hake (4X west)	61940	2247	2281	4229	4122
4VW Pollock	4429	6426	13840	8918	16528

	Biomass (mt)				
Stock/Region	2010	2009	2005-2009 Avg	1995-2009 Avg	*1970-2009 Avg
4X5Y Pollock (4X east)	13378	24145	10927	8945	17596
4X5Y Pollock (4X west)	5826	50278	54781	29496	25924
4VW Redfish	117253	97627	55029	42594	65009
4X5Y Redfish (4X east)	43251	274230	118934	67731	44801
4X5Y Redfish (4X west)	28642	43451	62765	31960	22555
4VW American Plaice	12038	12829	18754	17125	24912
4VW Witch Flounder	3955	11029	5843	3833	3938
4X5Y Witch Flounder (4X east)	241	368	452	659	674
4X5Y Witch Flounder (4X west)	2084	1664	867	892	1210
4VW Yellowtail Flounder	10197	16733	11814	10074	13782
4X5Y Winter Flounder (4X east)	404	576	598	1058	560
4X5Y Winter Flounder (4X west)	12580	6590	4422	3403	2669

* Silver hake, long term average is for 1982-2009.

Atlantic cod catches were widespread in the survey area but most catches were small. Only 3 sets caught greater than 50 kg, all occurring in 4V (Fig. 3a). The Biomass index for 4Vn increased in 2009 and remained high in 2010. The biomass indices in 2009 and 2010 were both above averages for the short and medium term periods, but remained well below the long term average. In 4VsW the biomass indices in both 2009 and 2010 were above the short and medium term averages. The biomass index declined from 2009, which was above the long term average and the highest since 1987. The biomass index in 4X east was above both the short and medium term averages in 2009, and near the long term average. The biomass index declined in 2010 and was the fourth lowest in the time-series. In 4X west, the cod biomass index for 2010 was the lowest in the series (Fig. 3b, Table 1).

Abundance indices for 4Vn were well below average for all lengths above 45 cm, but they were at or above average for smaller cod (Fig. 3c). In 4VsW, abundance in 2010 was above average for lengths 3-14 cm and 63-71 cm, but below average for all other lengths (Fig. 3d). Cod abundance in 4X east in 2010 is below average for all lengths except the 6-8 cm and 15-17 cm groupings (Fig. 3e). Similarly, in 4X west abundance is well below average for all lengths except for 3-8 cm lengths (Fig. 3f). Cod condition in 4VW shows no clear trend, and remains lower than in the 1970s. Condition in 4X east and west has also been variable and in 2010 is below average (Fig. 3g).

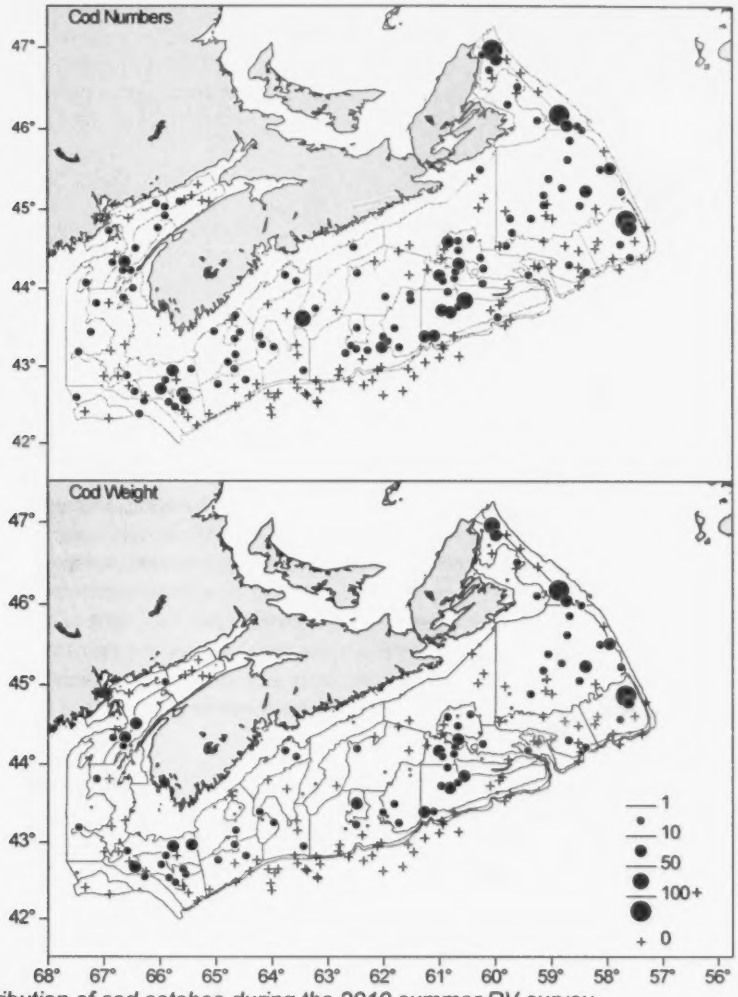

Figure 3a. Distribution of cod catches during the 2010 summer RV survey.

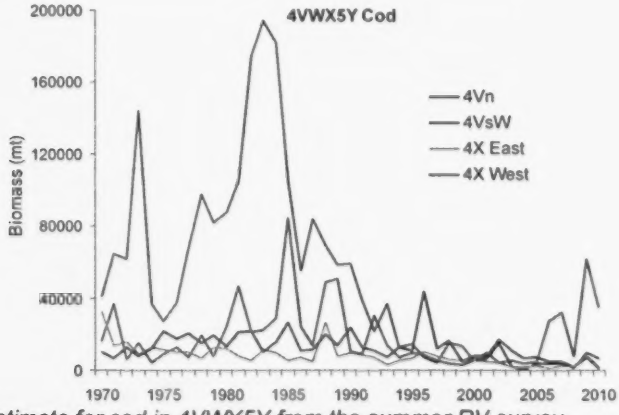

Figure 3b. Biomass estimate for cod in 4VWX5Y from the summer RV survey.

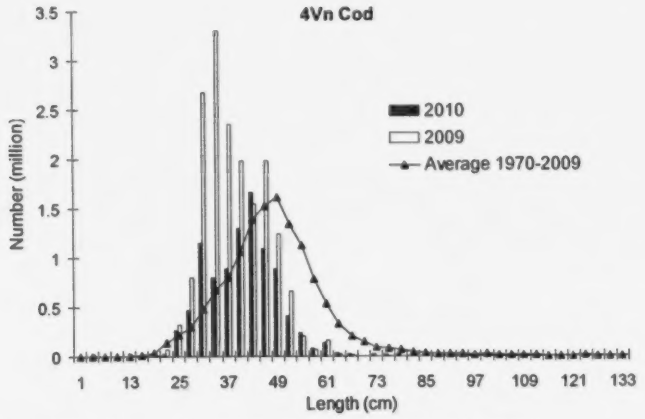

Figure 3c. Length composition for cod in 4Vn from the summer RV survey.

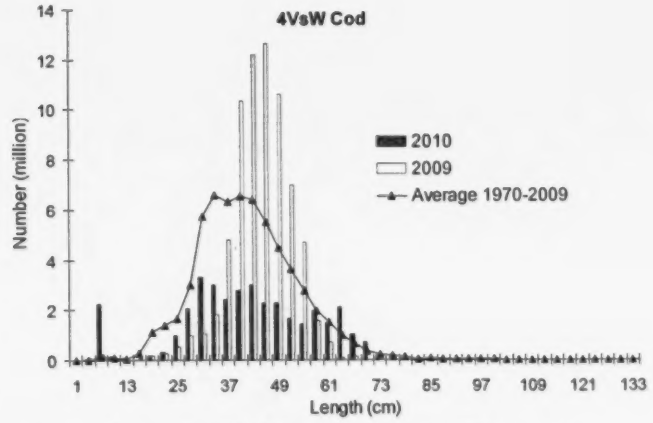

Figure 3d. Length composition for cod in 4VsW from the summer RV survey.

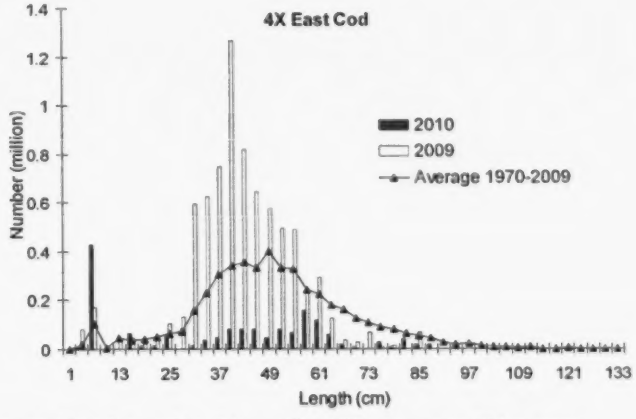

Figure 3e. Length composition for cod in 4X east from the summer RV survey.

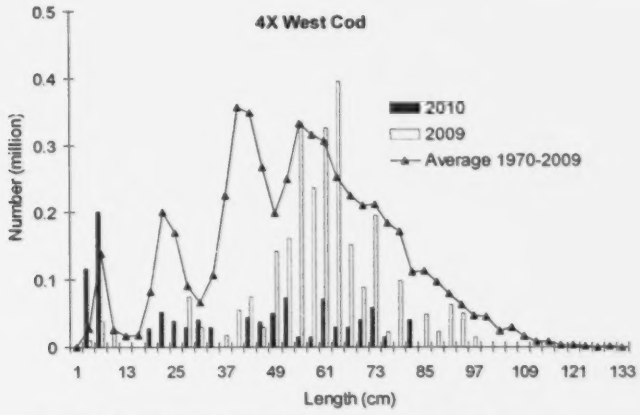

Figure 3f. Length composition for cod in 4X west from the summer RV survey.

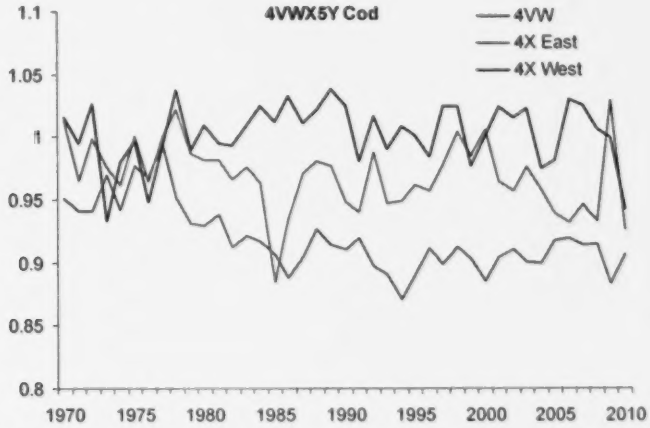

Figure 3g. Condition factor (Fulton's K) for cod in 4VWX5Y from the summer RV survey.

Haddock catches were widespread in 2010 (Fig. 4a). The biomass indices were lower in both 4X east and 4VW, with the latter declining from the highest point in the series in 2009. Biomass for all areas in 2010 was below the long term and medium term averages. 4X west is the only area where biomass is above the short term average (Fig. 4b, Table 1). The 4VW abundance indices are below average for most lengths, unlike in 2009. Catches at lengths <28cm (consistent with length at age 0 and 1) are about average in 4VW (Fig. 4c). In 4X east and 4X west, abundance is well above average for lengths up to 10.5 cm (age 0) but is below average for most other lengths<40 cm in 2010. Haddock condition declined in all areas in 2010, and remains below average (Fig. 4f).

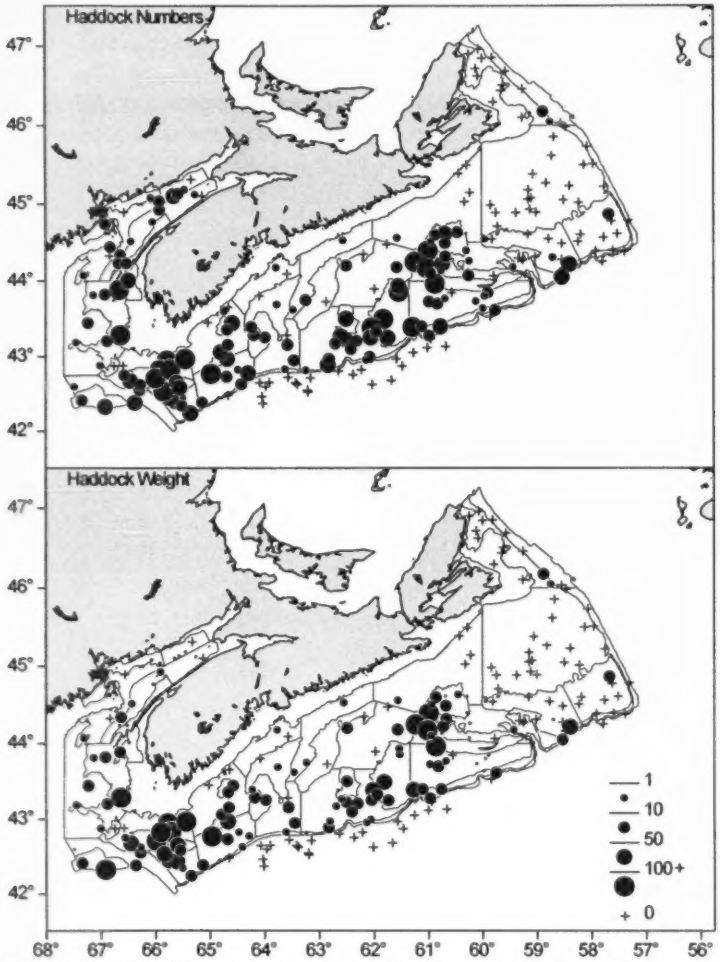

Figure 4a. Distribution of haddock catches during the 2010 summer RV survey.

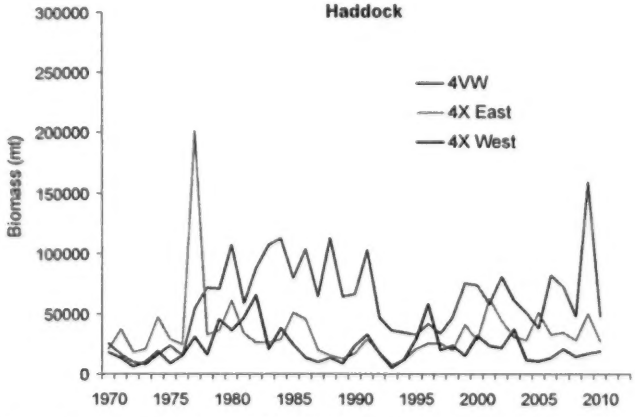

Figure 4b. Biomass estimate for haddock in 4VWX5Y from the summer RV survey.

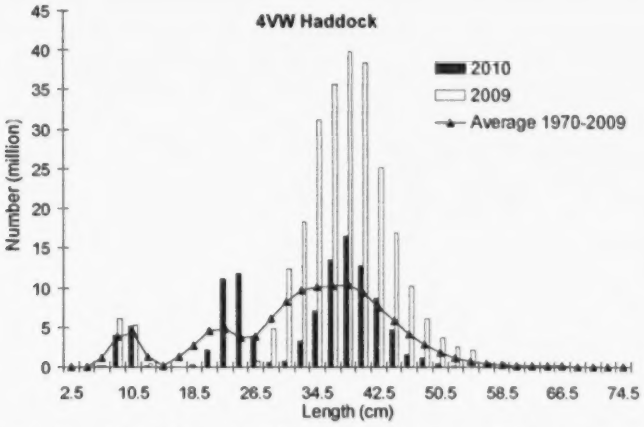

Figure 4c. Length composition for haddock in 4VW from the summer RV survey.

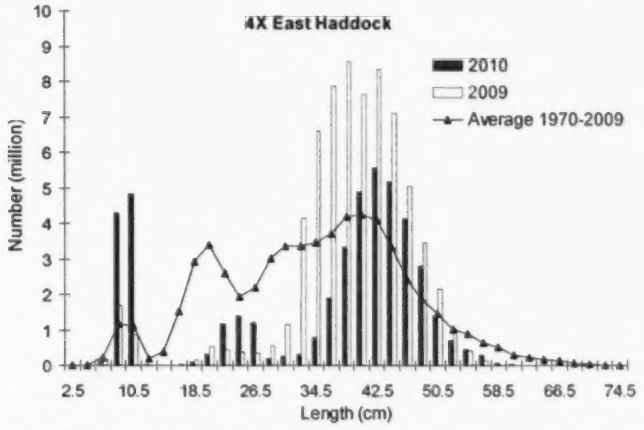

Figure 4d. Length composition for haddock in 4X East from the summer RV survey.

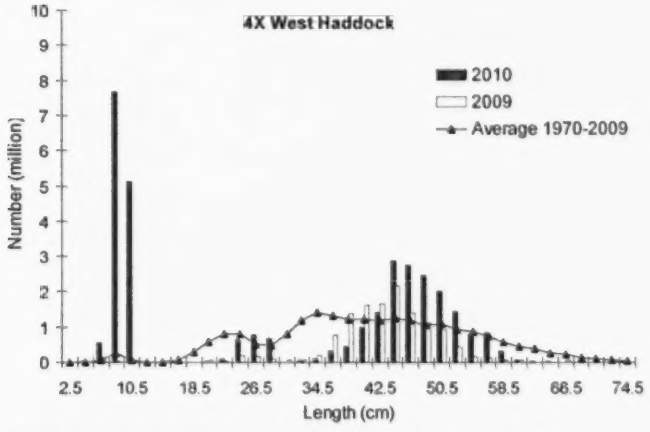

Figure 4e. Length composition for haddock in 4X West from the summer RV survey.

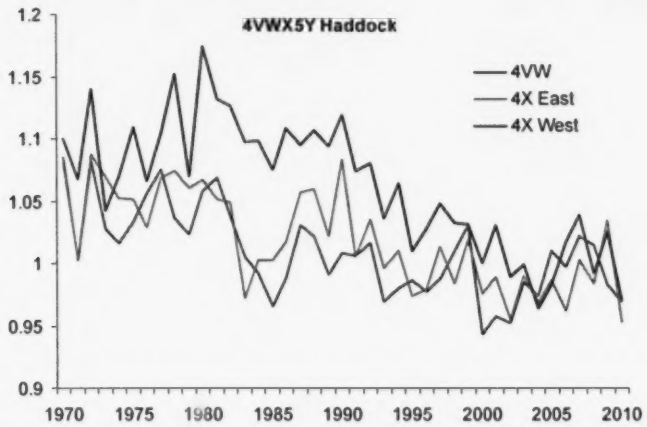

Figure 4f. Condition factor (Fulton's K) for haddock in 4VWX5Y from the summer RV survey.

White hake remain distributed throughout the survey area, with the largest catches in the Gulf of Maine (4Xpq) and in 4Vn (Fig. 5a). Biomass indices in 4VW, 4X east and 4X west are near the short and medium term averages, but all remain well below the long term average (Fig. 5b, Table 1). Abundance indices in 2010 continue to be below average for most lengths in 4VW (Fig. 5c). In 4X east, abundance is above average for most lengths less than 37 cm but well below average for most other lengths (Fig. 5d). Abundance in 4X west is high for lengths below 25 cm and near average for many other lengths (Fig. 5e). Condition of white hake declined in 2010 and is at the lowest for the time series in all areas (Fig. 5f).

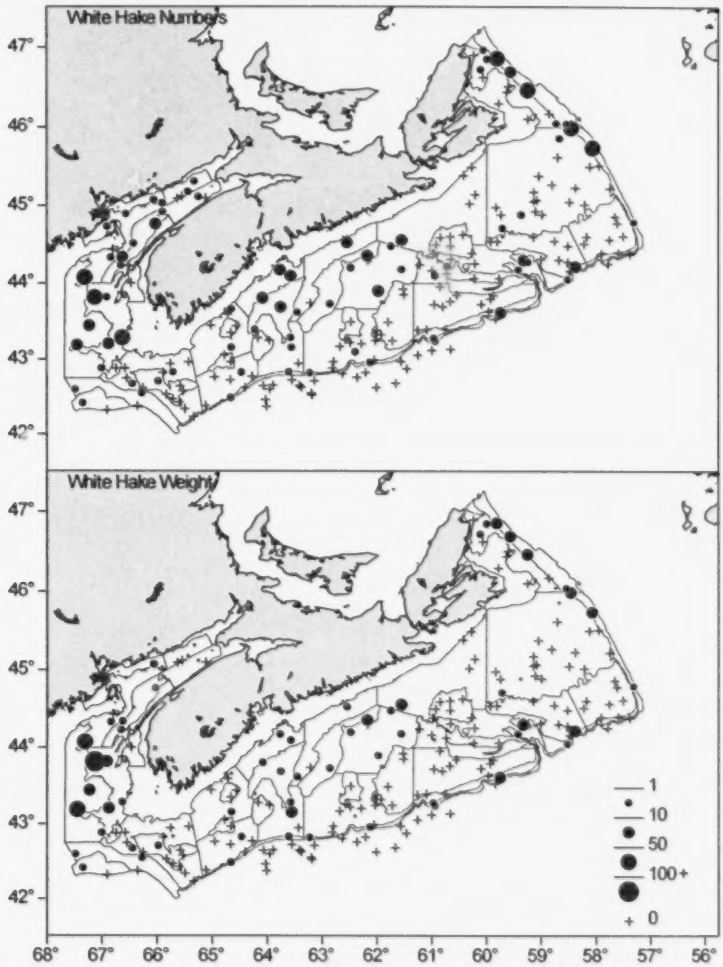

Figure 5a. Distribution of white hake catches during the 2010 summer RV survey.

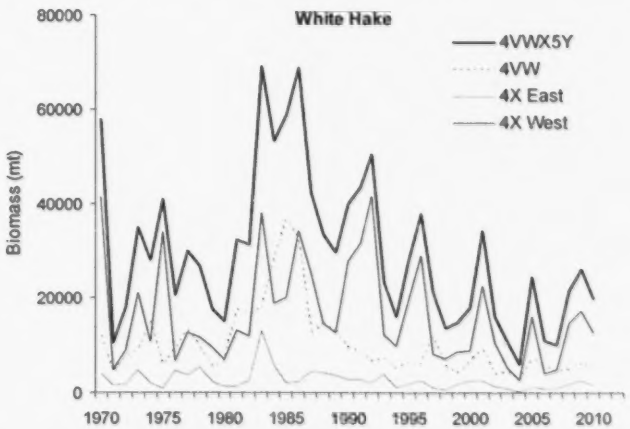

Figure 5b. Biomass estimate for white hake in 4VWX5Y from the summer RV survey.

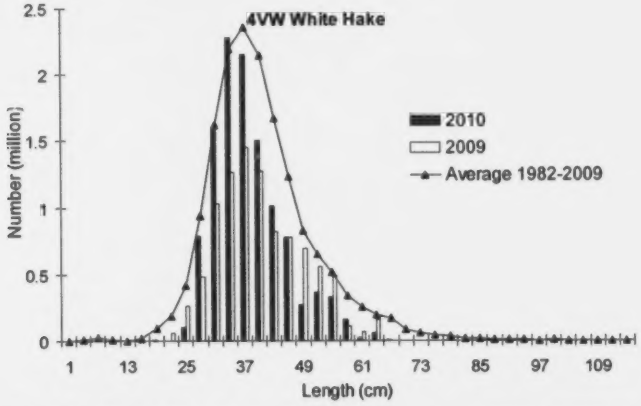

Figure 5c. Length composition for white hake in 4VW from the summer RV survey.

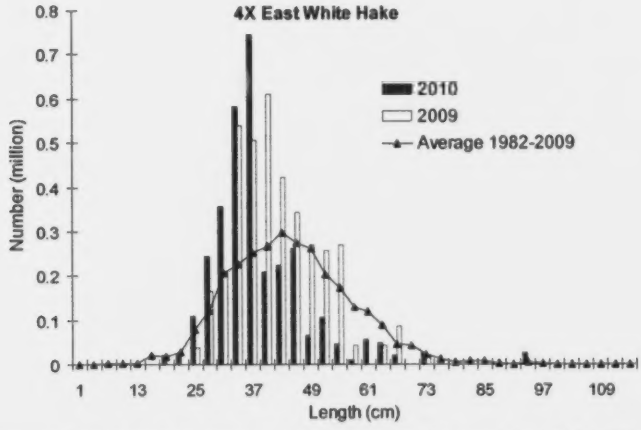

Figure 5d. Length composition for white hake in 4X East from the summer RV survey.

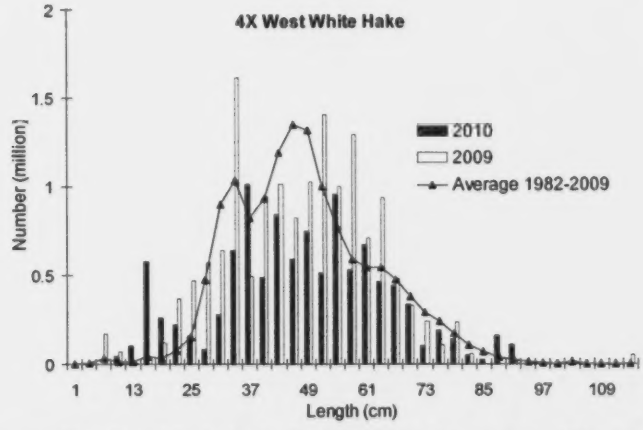

Figure 5e. Length composition for white hake in 4X West from the summer RV survey.

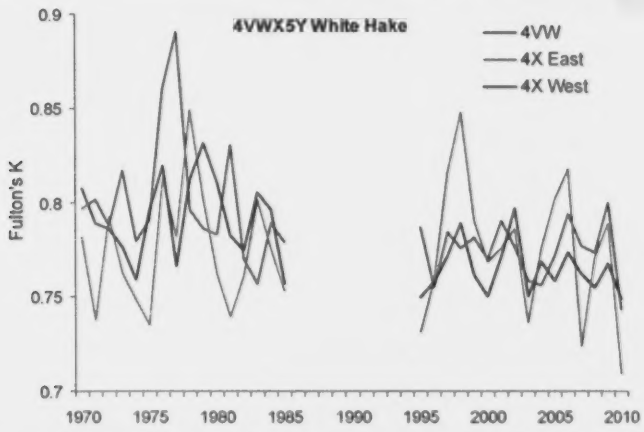

Figure 5f. Condition factor (Fulton's K) for white hake in 4VWX5Y from the summer RV survey.

Catches of **silver hake** in the 2010 survey were widespread, but with the bulk of the catches occurring in areas west of Sable Island (4WX5Y; Fig. 6a). The biomass index in 4VW increased slightly in 2010 and remains well above short, medium and long term averages. In 4X east, biomass remained close to the 2009 estimate and is above short and medium term averages, but below long term average. In 4X west, biomass increased in 2010 to the highest in the survey series; however, this was largely the result of one large catch at the mouth of the Bay of Fundy. The 2009 estimate was near the short term average and just below the medium and long term averages (Fig. 6b, Table 1). Indices of abundance are displayed for silver hake based on the assessment area, which comprises strata 440-483. The 2010 abundance indices are well above average for lengths below 20 cm, and are at or above average for most other lengths (Fig. 6c). Condition has increased since 2000 but declined in 2010 to just below average (Fig. 6d).

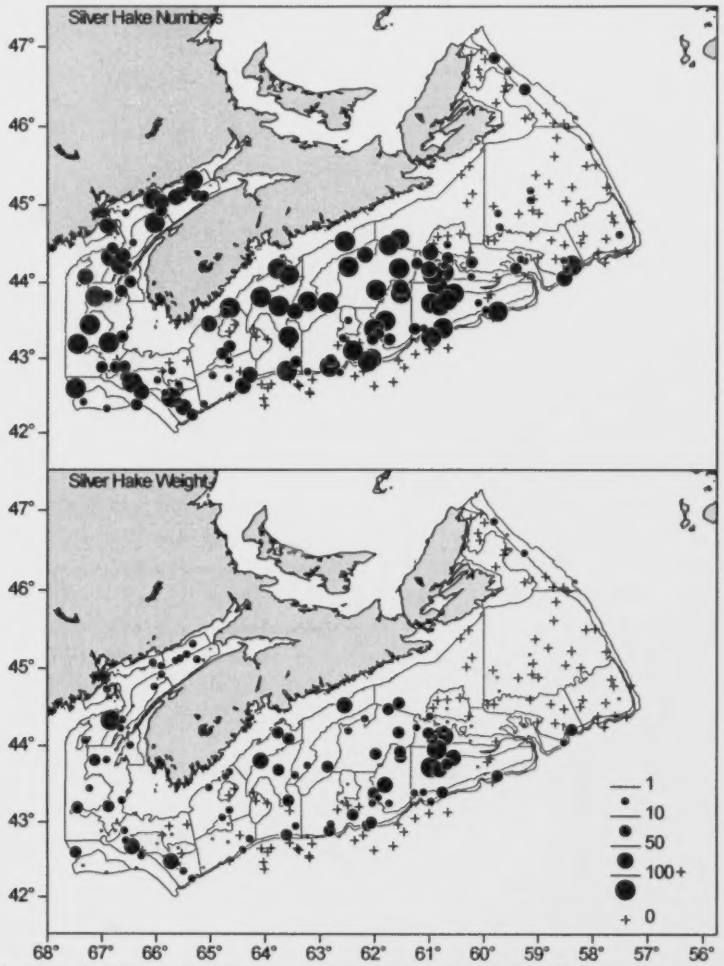

Figure 6a. Distribution of silver hake catches during the 2010 summer RV survey.

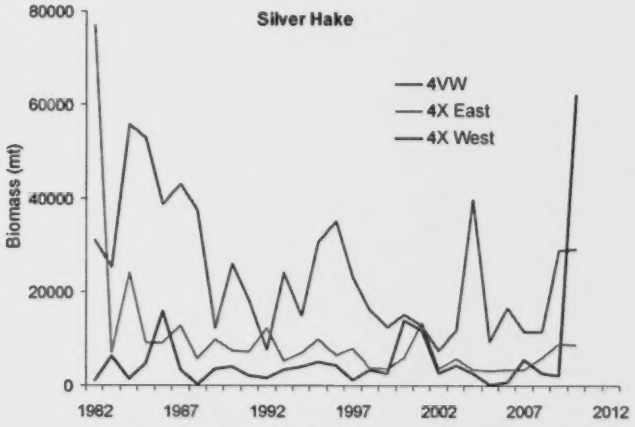

Figure 6b. Biomass estimate for silver hake in 4VWX from the summer RV survey.

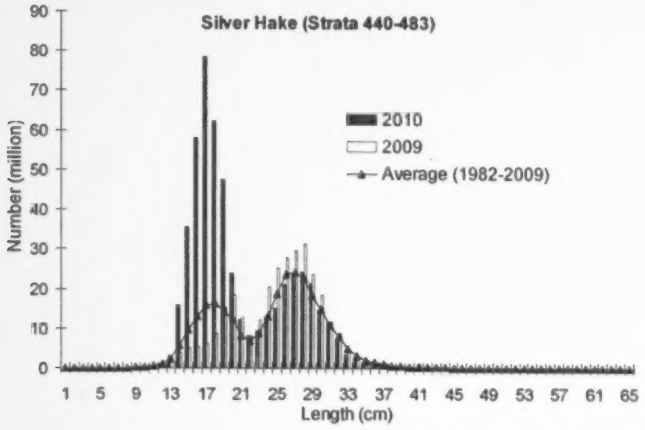

Figure 6c. Length composition for silver hake in strata 440-483 from the summer RV survey.

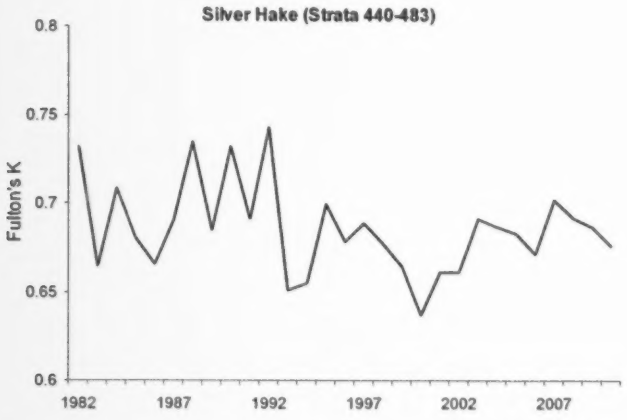

Figure 6d. Condition factor (Fulton's K) for silver hake in strata 440-483 from the summer RV survey.

Pollock catches were mainly located near the 4W-4X line and in the Gulf of Maine (Fig. 7a). Biomass in 4VW has declined annually since a peak in 2007 and in 2010 is below the short, medium and long term averages. In 4X east the 2009 estimate was high and although there was a decline in 2010, the estimate remains higher than the short and medium term averages. The biomass estimate in 4X west was near the short term average in 2009 but declined in 2010 to the lowest level observed since 1983; well below short, medium and long term averages (Fig. 7b, Table 1). Abundance indices in the eastern component are near or above average for lengths between 33 and 59 cm but there were very few large or small fish (Fig 7c). In the western component, the abundance indices were well below average in 2010 for all lengths, with the exception of 27-29 cm fish (Fig. 7d). Pollock condition shows a general decline since the beginning of the surveys and in 2010 is below average in all areas (Fig. 7e).

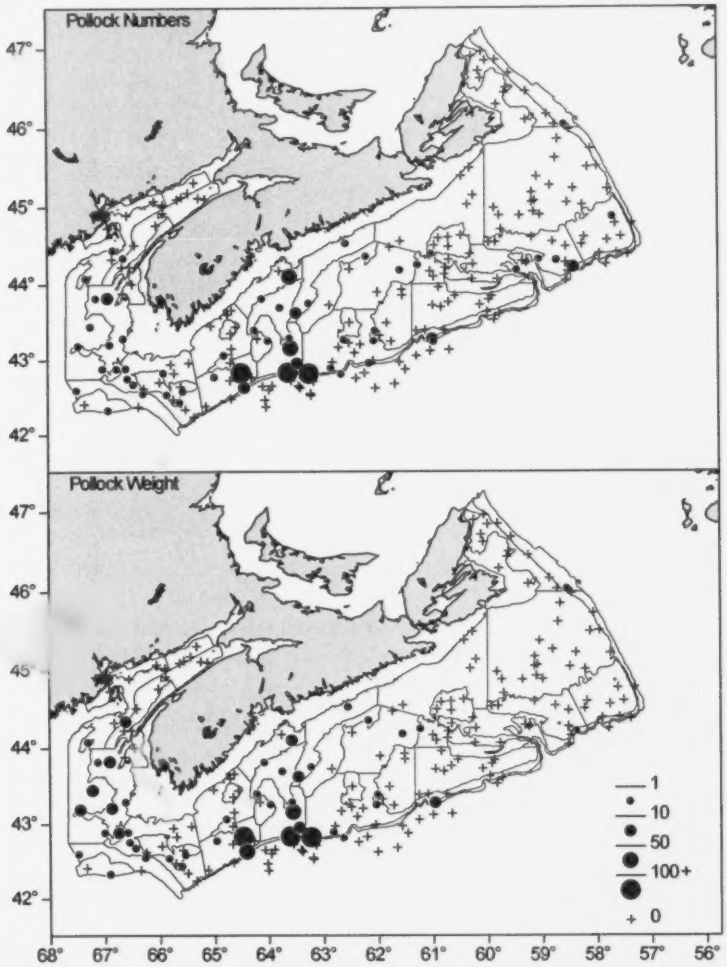

Figure 7a. Distribution of pollock catches during the 2010 summer RV survey.

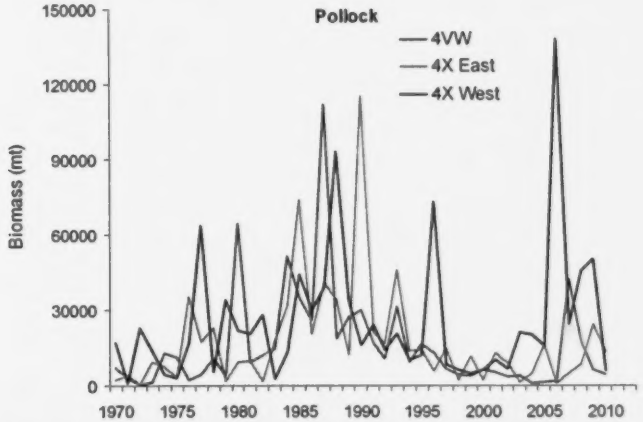

Figure 7b. Biomass estimate for pollock in 4VWX5Y from the summer RV survey.

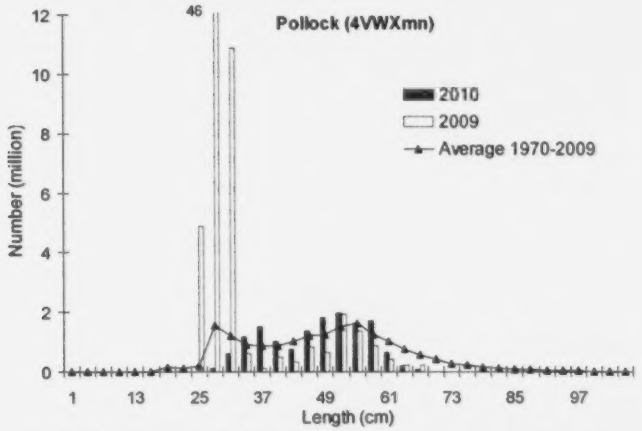

Figure 7c. Length composition for pollock in the Eastern component from the summer RV survey.

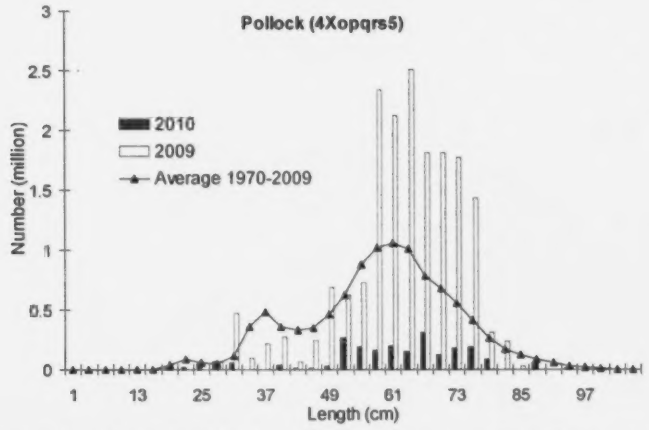

Figure 7d. Length composition for pollock in the Western component from the summer RV survey.

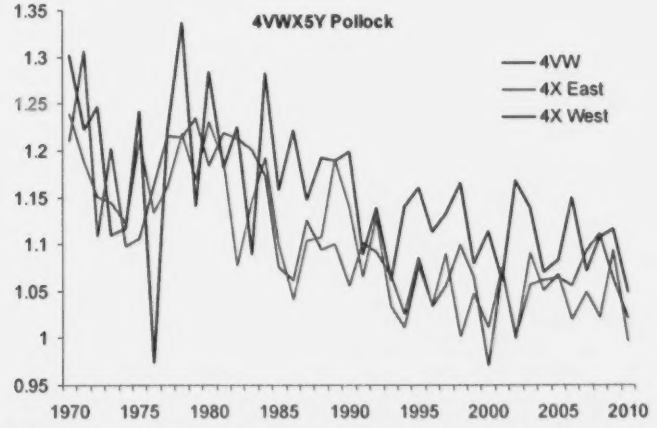

Figure 7e. Condition factor (Fulton's K) for pollock in 4VWX5Y from the summer RV survey.

Redfish catches were widespread throughout the survey area (Fig. 8a). The biomass index in 4VW has increased annually since 2007 and in 2010 is at its highest level in 20 years; higher than short, medium and long term averages (Fig. 8b, Table 1). In 4X east the biomass index was the highest for the series in 2009 and although biomass declined in 2010, it was near the long term average (Fig. 8a, Table 1). Redfish biomass in 4X west also declined in 2010 and is below short and medium term averages but near the long term average (Fig. 8b, Table 1). Abundance indices for Unit III redfish in 2010 are below 2009 levels at most lengths, but values are still above average for lengths 4 cm to 10 cm and also for lengths 20-25 cm. All other lengths are below average (Fig. 8c). In 2010, condition is below average for all areas and is the lowest in the series for 4X east (Fig. 8d).

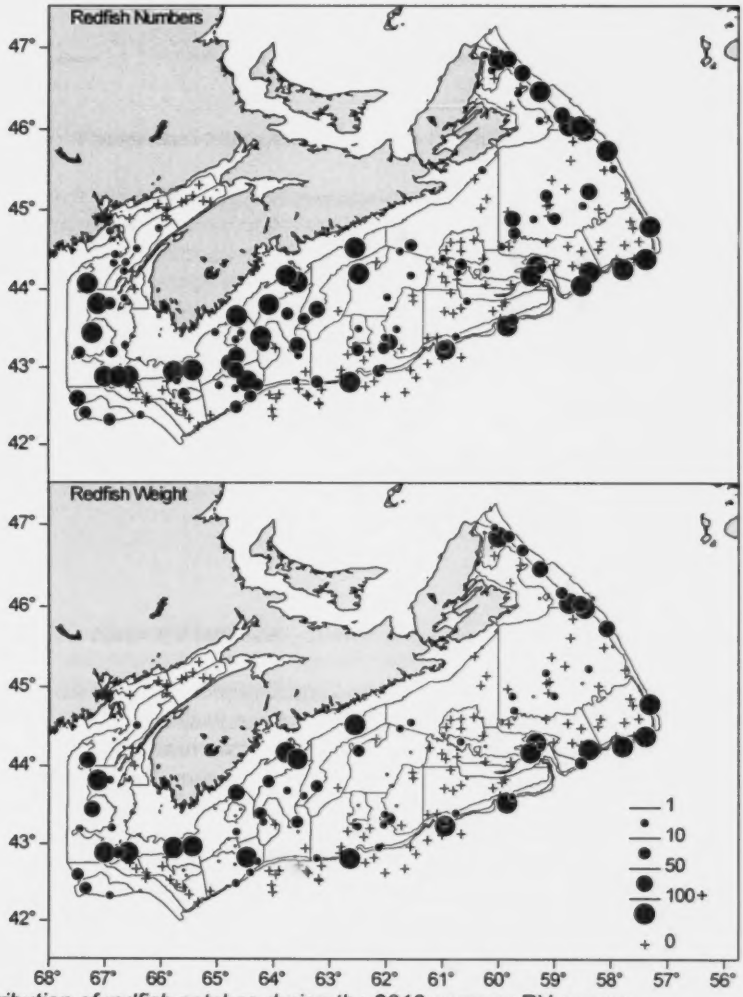

Figure 8a. Distribution of redfish catches during the 2010 summer RV survey.

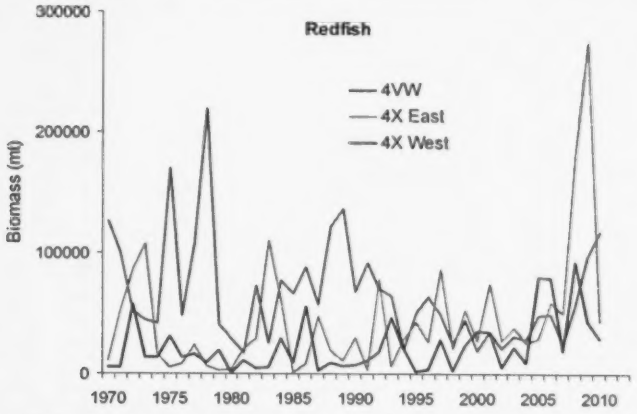

Figure 8b. Biomass estimate for redfish in 4VWX5Y from the summer RV survey.

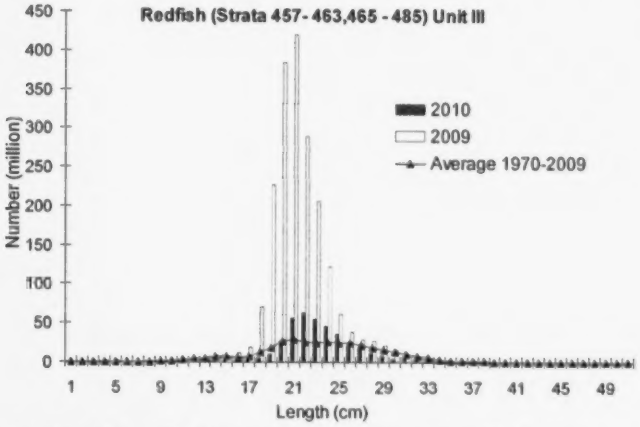

Figure 8c. Length composition for redfish in Unit 3 from the summer RV survey.

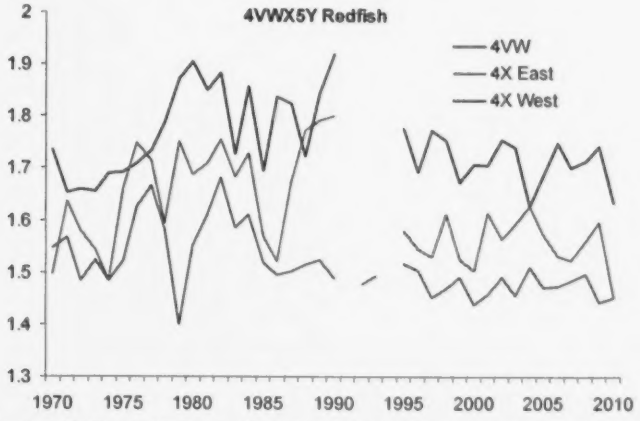

Figure 8d. Condition factor (Fulton's K) for redfish in 4VWX5Y from the summer RV survey.

The three species that constitute **4VW flatfish** are American plaice, witch flounder, and yellowtail flounder. Winter flounder and witch flounder are the two main species that make up **4X5Y flatfish**. Details on each individual species are presented below.

American plaice were widespread throughout the survey area in 2010, with the largest catches primarily in 4V (Fig. 9a). Biomass indices reached a recent peak in 2006 but have declined annually since then. The 2010 biomass estimate is below all averages and is the third lowest in the series (Fig. 9b, Table 1). Abundance indices in 2010 are similar to those for 2009. All lengths are below average, with the exception of some of the lengths less than 18 cm (Fig. 9c). Condition of 4VW American plaice has shown a general decline and is well below average in 2010 (Fig. 9d).

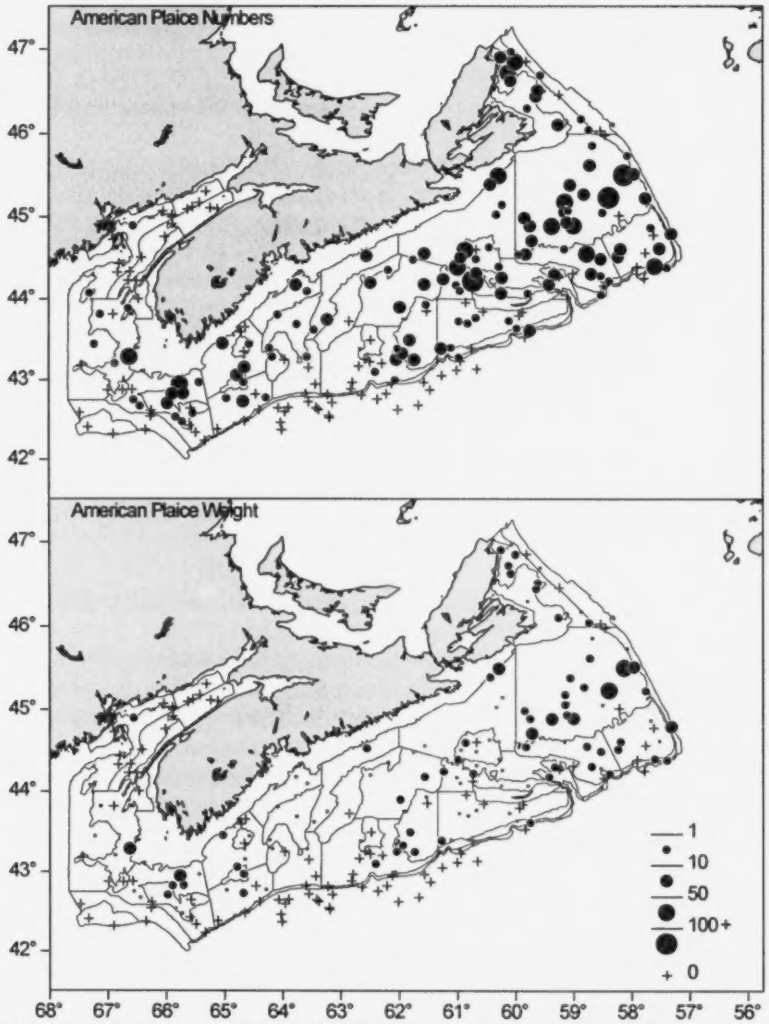

Figure 9a. Distribution of American plaice catches during the 2010 summer RV survey.

Figure 9b. Biomass estimate for American plaice from the summer RV survey.

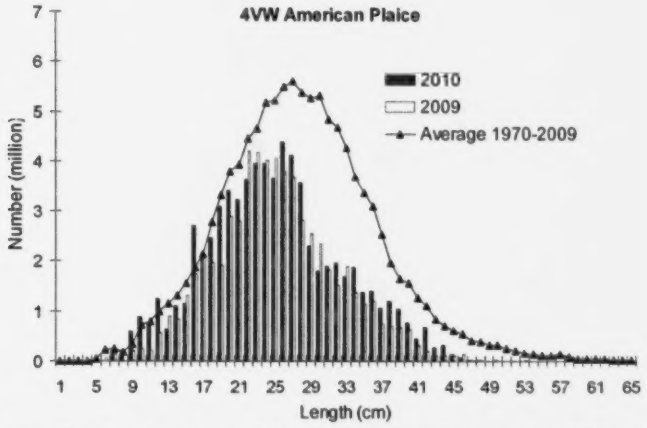

Figure 9c. Length composition for American plaice in 4VW from the summer RV survey.

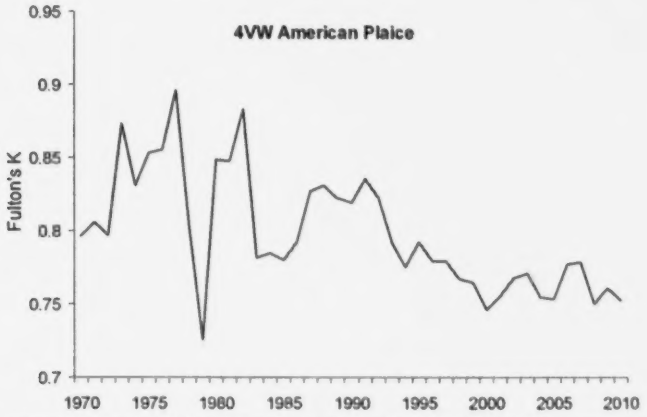

Figure 9d. Condition factor (Fulton's K) for American plaice in 4VW from the summer RV survey.

Witch flounder were caught throughout the survey area (Fig. 10a). The biomass index for 4VW has shown a general increase since the early 1990's. In 2010, the biomass index was below the short term average but remained near the medium and long term averages. In 4X

east, the biomass index remains below short, medium and long term averages, while biomass in 4X west has been increasing since 2007 and in 2010 was above short, medium and long term averages (Fig. 10b, Table 1). Abundance indices for 4VW fell from 2009 levels but remained above average for most lengths below 40 cm (Fig. 10c). In 4X east, abundance is above average for some scattered lengths but very low for lengths >42 cm (Fig. 10d). Abundance in 4X west was higher than 2009 and above average at most smaller sizes (Fig. 10e). Lengths greater than 49 cm continue to be absent from the survey catches. Condition of witch flounder is variable in all areas, but generally lower since 1994 than in earlier years. Condition declined from 2009 to 2010 for all areas and was slightly below average (Fig. 10f).

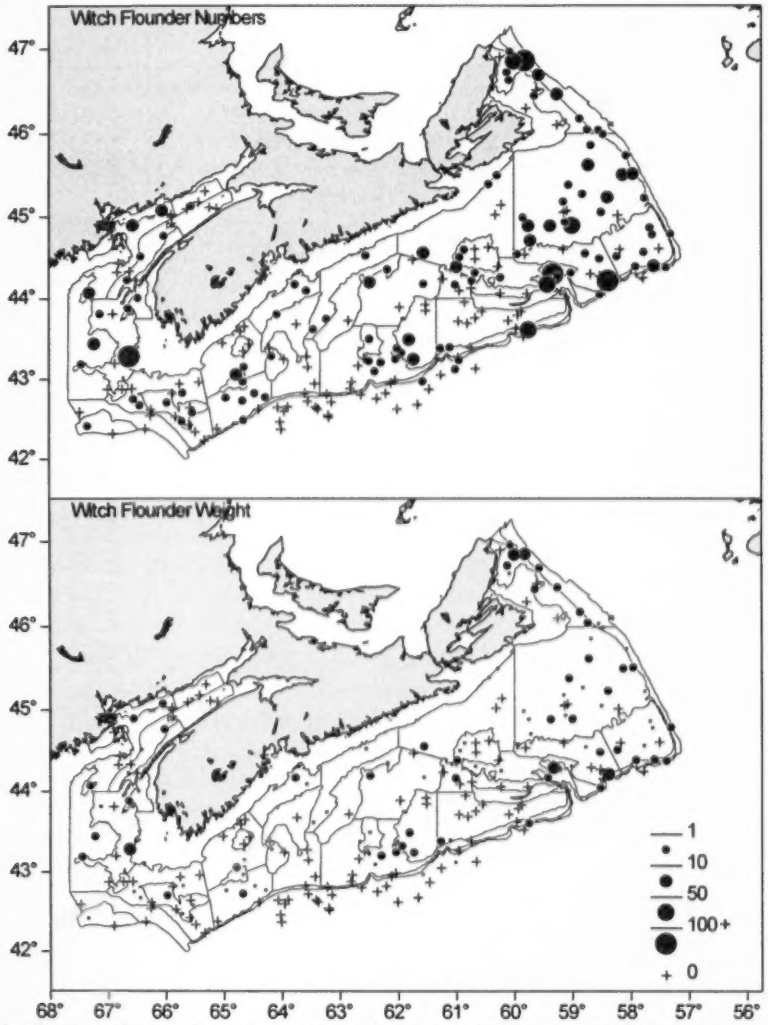

Figure 10a. Distribution of witch flounder catches during the 2010 summer RV survey.

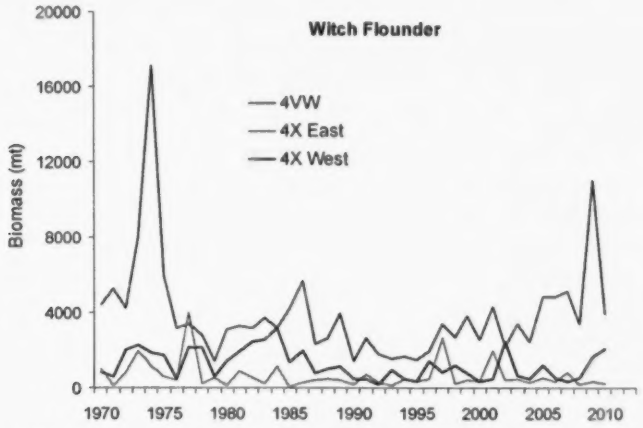

Figure 10b. Biomass estimate for witch flounder from the summer RV survey.

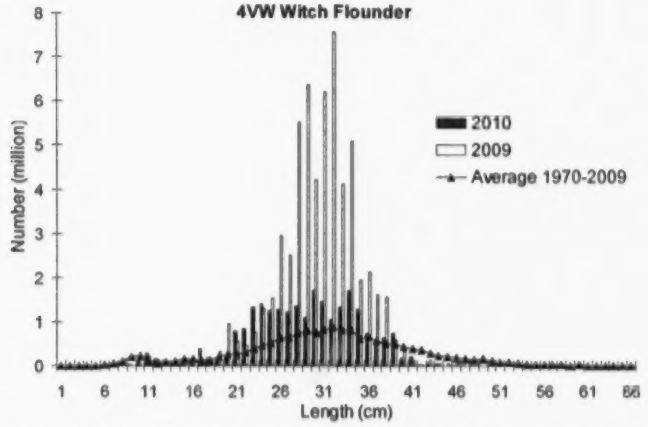

Figure 10c. Length composition for witch flounder in 4VW from the summer RV survey.

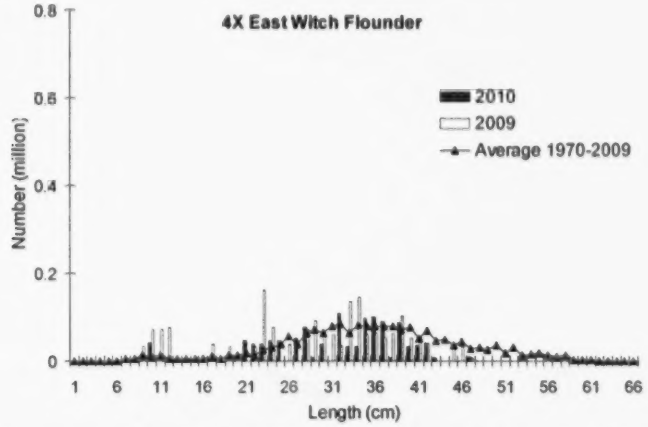

Figure 10d. Length composition for witch flounder in 4X East from the summer RV survey.

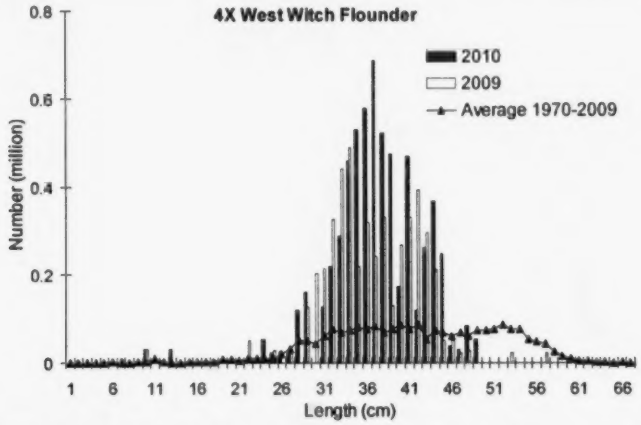

Figure 10e. Length composition for witch flounder in 4X West from the summer RV survey.

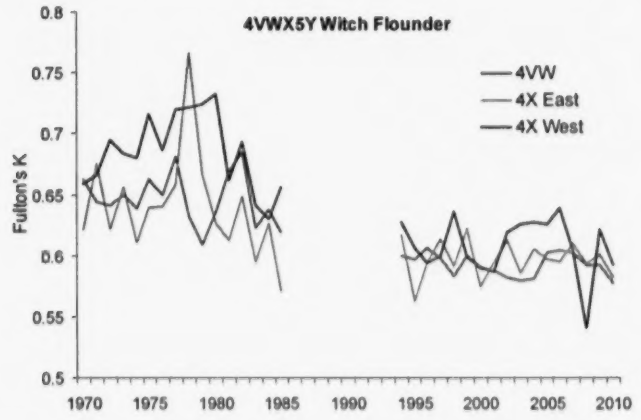

Figure 10f. Condition factor (Fulton's K) for witch flounder in 4VWX5Y from the summer RV survey.

Most **yellowtail flounder** catches in 2010 were caught in 4VW, with a small percentage caught in 4X (Fig. 11a). The biomass index for 4VW reached a low in 2003 but has since shown a general increase. In 2010, the biomass index declined and is below the short and long term average but near the medium term average (Fig. 11b, Table 1). Abundance of yellowtail flounder is above average for lengths less than 27 cm, but is less than average for all lengths greater than 27 cm (Fig. 11c). Yellowtail flounder condition has been fairly stable since 1994 and is near average in 2010 (Fig. 11d).

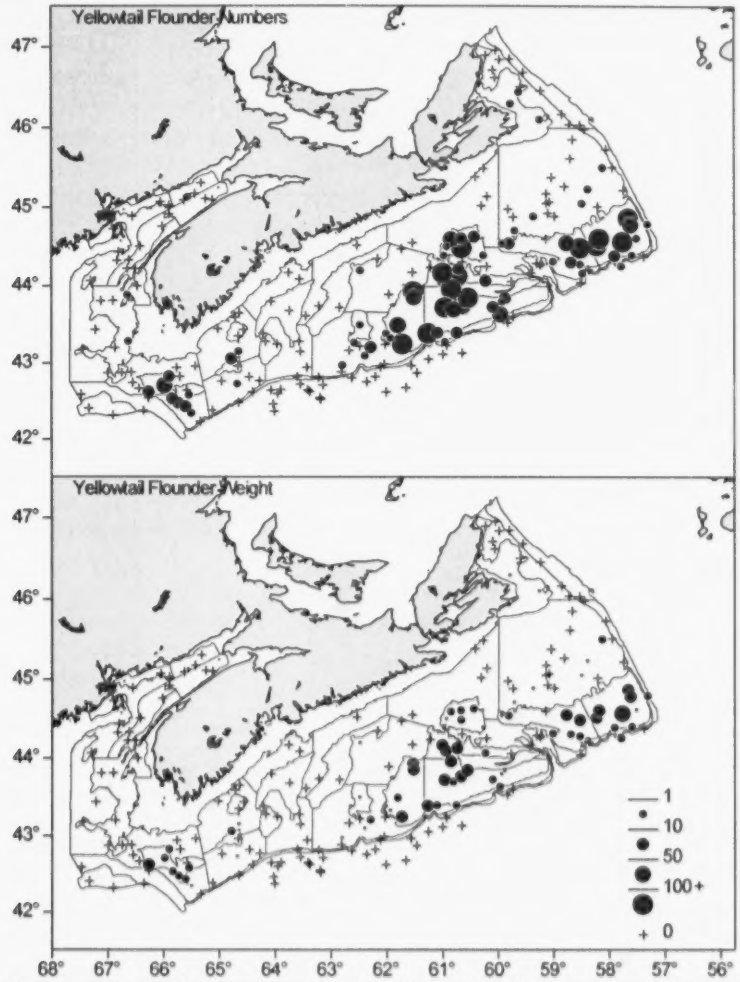

Figure 11a. Distribution of yellowtail flounder catches during the 2010 summer RV survey.

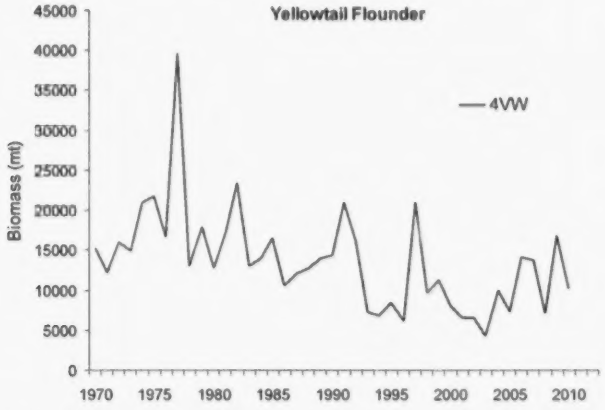

Figure 11b. Biomass estimate for yellowtail flounder from the summer RV survey.

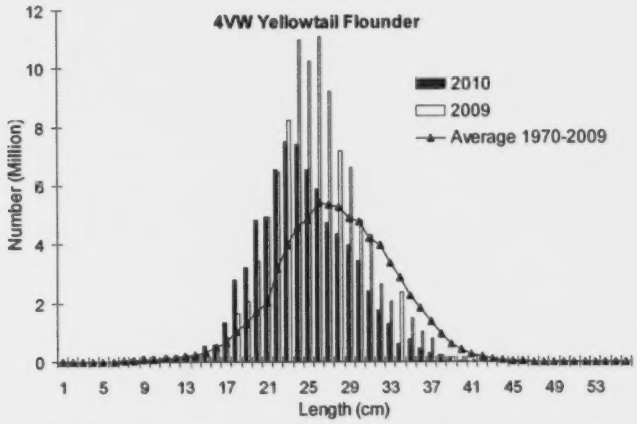

Figure 11c. Length composition for yellowtail flounder in 4VW from the summer RV survey.

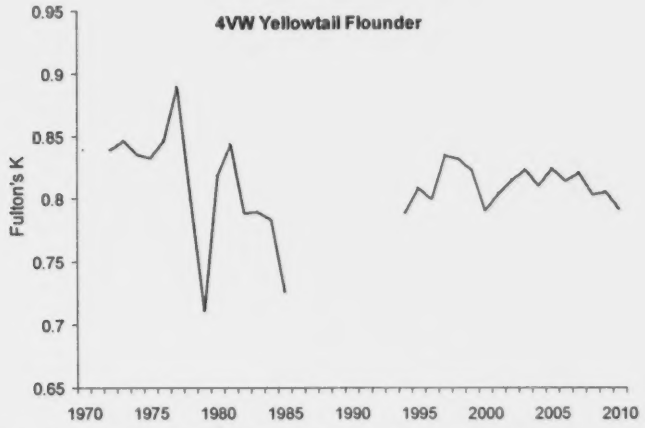

Figure 11d. Condition factor (Fulton's K) for yellowtail flounder in 4VW from the summer RV survey.

Winter flounder were caught mainly in the Bay of Fundy with smaller catches also occurring on Browns Bank and Western Bank (Fig. 12a). Biomass indices in 4X east in 2010 were below short, medium and long term averages. In 4X west, the biomass index increased again in 2010 to the highest in the series, with the 2009 value being the second highest (Fig. 12b, Table 1). Abundance indices of winter flounder in 4X east were near average for most lengths between 25 and 40 cm, but below average for larger fish (Fig. 12c). In 4X west, abundance was well above average for all lengths < 38 cm, and near average above 38 cm (Fig. 12d). Winter flounder condition declined from 2009 in both areas. In 4X east, condition was below average and in 4X west, condition was the lowest in the time series (Fig. 12e).

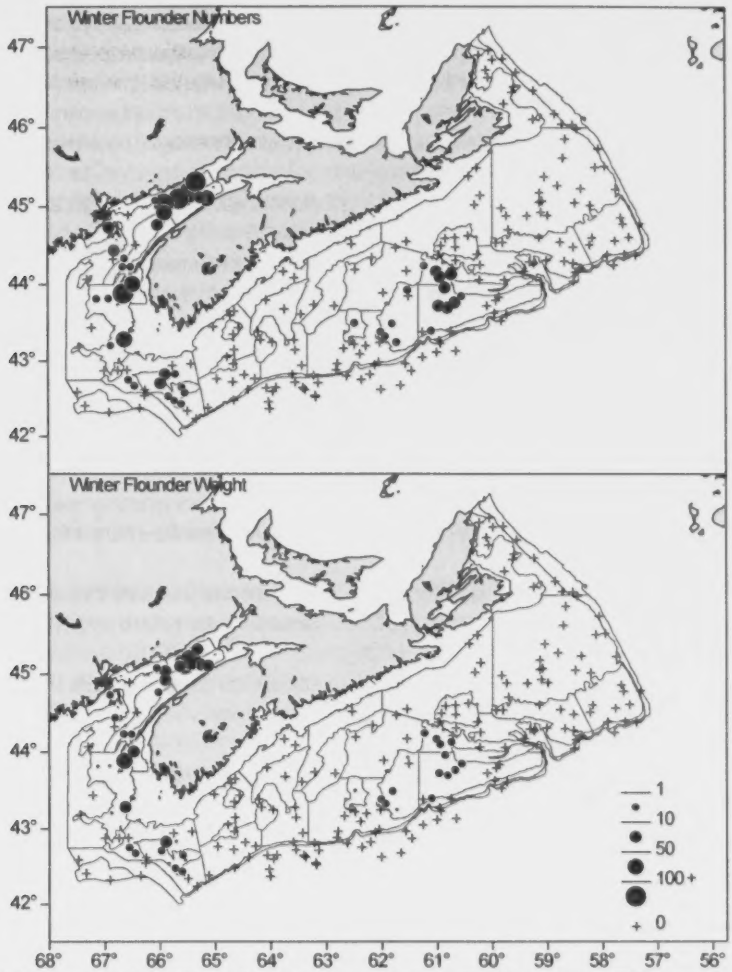

Figure 12a. Distribution of winter flounder catches during the 2010 summer RV survey.

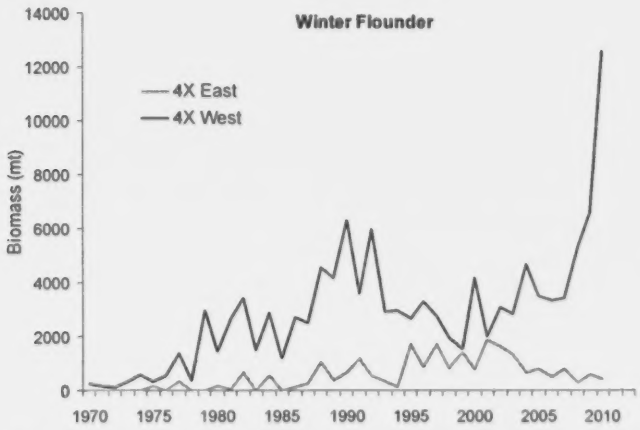

Figure 12b. Biomass estimate for winter flounder from the summer RV survey.

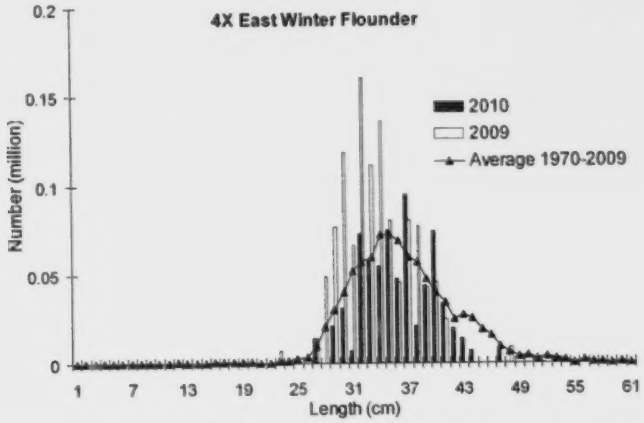

Figure 12c. Length composition for winter flounder in 4X East from the summer RV survey.

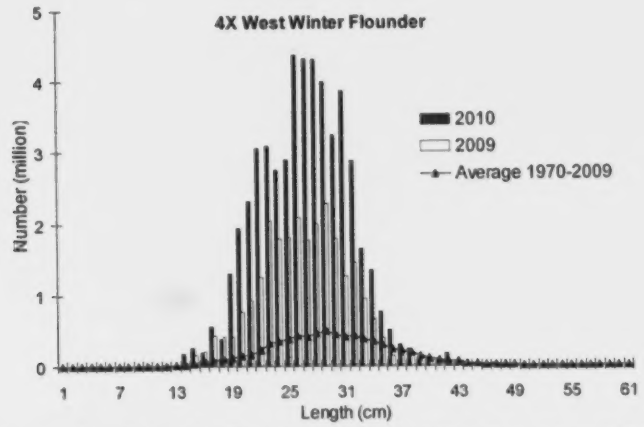

Figure 12d. Length composition for winter flounder in 4X West from the summer RV survey.

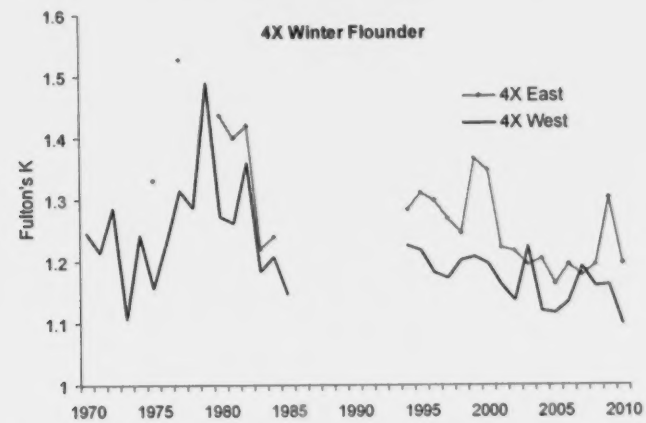

Figure 12e. Condition factor (Fulton's K) for winter flounder in 4X from the summer RV survey.

Conclusions

Biomass indices for 4X cod, while comparable to short and medium term averages in 2009 are both low in 2010 Biomass indices for 4Vn cod in 2009 and 2010 are well above short and medium term averages. Biomass indices for 4VsW cod in 2009 and 2010 are well above short and medium term averages. Biomass indices for 4X haddock in 2009 and 2010 have no consistent relationship to short and medium term averages. Biomass indices for 4VW haddock in 2009 and 2010 have no consistent relationship to short and medium term averages. Biomass indices for 4X white hake in 2009 and 2010 are well above short and medium term averages. Biomass indices for 4VW white hake in 2009 and 2010 have no consistent relationship to short and medium term averages. Biomass indices of 4VWX5 silver hake in 2009 and 2010 are above short and medium term averages. Biomass indices for 4VWX5 pollock, while comparable to short and medium term averages in 2009 are both low in 2010. The recent average biomass indices for Unit III redfish are above the medium term and long term average and the indices remain high relative to the long term average in 2009 and 2010. Winter flounder biomass indices in 4X in 2009 and 2010 are at the highest levels observed in the time series and well above short, medium and long term averages. Biomass indices for 4VW American Plaice in 2009 and 2010 were below short, medium and long term averages.

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